Wave Propagation Across Muddy Seafloors

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Award Number: N00014-07-1-0461

Summary of Results

The **primary objective** was to develop field-verified models for the evolution of surface-gravity waves propagating over a muddy seafloor, allowing more skillful predictions of wave fields on continental shelves, and enabling the estimation of characteristics of the seafloor from wave observations. The **approach** was to investigate empirical and theoretical expressions for mud-induced damping by comparing field observations with numerical model simulations. The damping caused by a muddy seafloor was investigated by simultaneously observing surface waves, near-bottom currents, and in collaboration with MURI investigators, characteristics of the mud layer and associated sediments. The field observations have allowed testing of existing hypotheses for mud-induced damping of the wave field, as well as the development of new formulations and parameterizations for the dissipation that can be used in both research and operational wave models.

The observations are being used by several colleagues for additional studies of wind-driven waves propagating across shallow seafloors. Collaborators using our field observations include Drs. A. Sheremet (U. Florida), T.H.C. Herbers (Naval Postgraduate School), T. Janssen (San Francisco State U.) and their graduate students and post-doctoral researchers. In addition, MURI collaborators Drs. P Traykovski and J. Trowbridge (WHOI) also are using our field observations in their studies of mud-induced dissipation.

The field observations are available on line at
http://science.whoi.edu/users/elgar/WORMSEX/index.html.

All time series, as well as processed data products (means, variances, spectra) are available. Many scientists, students, and engineers from universities, government laboratories, the Department of Defense, and private companies have downloaded the observations.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
03-10-2011	Final	01/01/07 – 12/31/10

4. TITLE AND SUBTITLE

Wave Propagation Across Muddy Seafloors

5a. CONTRACT NUMBERS

5b. GRANT NUMBER

N00014-07-10461

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

130461SP

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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Woods Hole, MA 02543

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Office of Naval Research
875 North Randolph Street
Arlington, VA 22203-1995

10. SPONSORING/MONITORING ACRONYM(S)

ONR

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The primary objective was to develop field-verified models for the evolution of surface-gravity waves propagating over a muddy seafloor, allowing more skillful predictions of wave fields on continental shelves, and enabling the estimation of characteristics of the seafloor from wave observations. The approach was to investigate empirical and theoretical expressions for mud-induced damping by comparing field observations with numerical model simulations. The damping caused by a muddy seafloor was investigated by simultaneously observing surface waves, near-bottom currents, and in collaboration with MURI investigators, characteristics of the mud layer and associated sediments. The field observations have allowed testing of existing hypotheses for mud-induced damping of the wave field, as well as the development of new formulations and parameterizations for the dissipation that can be used in both research and operational wave models.

15. SUBJECT TERMS

tidal flats, surfzone, nearshore circulation, sediment transport

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
R	b. ABSTRACT	c. THIS PAGE			Steve Elgar
U	U	U	U	3	19 b. TELEPHONE NUMBER *(Include are code)* (508) 289-3614

Results from this project are described in detail in the following publications:

Elgar, Steve and Britt Raubenheimer, Wave dissipation by muddy seafloors, 2008 *Geophysical Research Letters*, L07611, doi:10.1029/2008GL033245.

Falchetti, Sylvia, Daniel Conley, Maurizio Brocchini, and Steve Elgar, 2010 Nearshore bar migration and sediment-induced buoyancy effects, *Continental Shelf Research* **30**, 226-238.

Moulton, M., B. Raubenheimer, S. Elgar, and E. Ladouceur, Nearshore circulation over a muddy seafloor, *EOS, Trans. AGU* **89, OS33C-1359,** 2008.

Safak, I., A. Sheremet, S. Elgar, & B. Raubenheimer, Nonlinear wave propagation across a muddy seafloor, *EOS, Trans. AGU* **91, PO14B-03,** 2010.

Engelstad, A., T. Janssen, T. Herbers, S. Elgar, & B. Raubenheimer, Observations of wave-mud interaction across the Louisiana shelf, *EOS, Trans. AGU* **91, PO25C-20,** 2010.

Engelstad, A., T. Janssen, G. van Vledder, T. Herbers, S. Elgar, & B. Raubenheimer, Wave damping across the Louisiana shelf, *EOS, Trans. AGU* **91, OS51B-1299,** 2010.